

CLAIMS

1. A control system for a machine which includes a load handling apparatus, the load being moveable relative to a body of the machine by the load handling apparatus, the machine including a pivot about which a tipping moment is produced by the load, the load handling apparatus including an actuator and being capable of moving the load to a position at which the tipping moment is at a predetermined threshold value, the control system including a sensor to sense the tipping moment and in use, to provide an input to a controller, the controller being responsive to the input to influence operation of the actuator so that in the event that the sensor senses that the value of the tipping moment is approaching the threshold value, the speed of movement of the load is progressively reduced.
2. A system according to claim 1 wherein the load handling apparatus is a lifting arm which is moveable about a generally horizontal axis relative to the body of the machine, the arm thus being capable of raising and lowering the load upon operation of a first actuator.
3. A system according to claim 2 wherein the controller influences operation of the first actuator as the tipping moment approaches the threshold value.
4. A system according to claim 2 wherein the lifting arm includes a plurality of relatively moveable sections, and the controller influences operation of a second actuator which relatively moves the arm sections as the tipping moment approaches the threshold value.

5. A system according to claim 4 wherein the relatively moveable sections are telescopic.
6. A system according to claim 2 wherein the arm carries a load handling implement which is movable on the arm by operation of a third actuator and the controller influences operation of the third actuator as the tipping moment approaches the threshold value.
7. A system according to claim 6 wherein the load handling implement is a loading forks.
8. A system according to any one of claims 1 to 7 wherein the speed of movement of the load is progressively reduced and is stopped altogether when the tipping moment is at the threshold value.
9. A system according to any one of the preceding claims wherein the machine includes a ground engaging structure by which the machine is supported on the ground.
10. A system according to claims 9 wherein the ground engaging structure includes a pair of supports, the tipping moment being produced about a pivot axis established by one of the supports.
11. A system according to claim 10 wherein the tipping moment is sensed by the sensor sensing loading of one of the supports.
12. A system according to any one of claims 9 to 11 wherein the machine is a wheeled load handling machine having a ground engaging structure including a pair of supports provided by axles which each carry wheels.

13. A system according to claim 12 wherein the tipping moment is produced about a rotational axis of one of the pairs of wheels and the sensor senses the loading on the other pair of wheels.

14. A system according to any one of the preceding claims wherein the actuator the operation of which is influenced, is a fluid operated actuator, the controller influencing operation of the actuator by reducing a flow of fluid to or from the actuator.

15. A system according to claim 14 wherein the system includes a main control valve for providing fluid to the actuator, and a valve which is independent of the control valve but responsive to the controller to reduce the flow of fluid to and from the actuator as the sensed tipping moment approaches the threshold value.

16. A system according to claim 14 or claim 15 wherein the fluid operated actuator is a double acting linear hydraulic ram.

17. A system according to any one of the preceding claims wherein the sensor is a transducer which provides an electrical input signal to the controller.

18. A system according to any one of the preceding claims wherein where the load handling apparatus includes a plurality of actuators, the controller influences the operation of one of the actuators as the value of the tipping moment approaches the threshold value by progressively reducing the permitted flow of fluid from the actuator, and prevents the flow of fluid to or from the remaining actuator or at least one of the remaining actuators if the tipping moment value reaches the threshold value, whilst permitting only further

actuator correctional operation which will result in a reduction in the tipping moment.

19. A system according to claim 18 wherein where the load handling implement is a lifting forks, and during any permitted correctional actuator operation, the attitude of the lifting forks relative to the ground is automatically maintained.

20. A system according to claim 19 where appendant to claim 2 wherein the load handling apparatus is a lifting arm and the machine includes a displacement actuator which is operated as the lifting arm is raised and lowered to exchange fluid with an actuator which controls the attitude of the load handling implement relative to the ground, and during correctional actuator operation, when the actuator is isolated, fluid pressure in a circuit containing the attitude controlling and displacement actuators is maintained.

21. A system according to any one of the preceding claims wherein the controller operates according to an algorithm which enables the controller to ignore transient changes of loading sensed by the sensor as a result of changing machine dynamics or of reaction to initial lift arm movements.

22. A control system for a machine substantially as hereinbefore described with reference to and/or as shown in the accompanying drawings.

23. A machine having a control system according to any one of the preceding claims.

24. A machine substantially as hereinbefore described with reference to and/or as shown in the accompanying drawings.

25. A load handling apparatus controlled by a control system according to an one of claims 1 to 22.

26. A load handling apparatus substantially as hereinbefore described with reference to and/or as shown in the accompanying drawings.

27. A method of operating a load handling system according to claim 26 or claim 27 including progressively reducing to speed of lowering of the load in response to increasing machine instability.

27. Any novel feature or novel combination of features described herein and/or as shown in the accompanying drawings.